

(19) World Intellectual Property
Organization
International Bureau



07 JUN 2005



(43) International Publication Date
8 July 2004 (08.07.2004)

PCT

(10) International Publication Number
WO 2004/057406 A3

(51) International Patent Classification⁷: **G02B 26/06,**
G06B 26/08, G02B 7/18

(21) International Application Number:
PCT/GB2003/005507

(22) International Filing Date:
18 December 2003 (18.12.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0230038.2 23 December 2002 (23.12.2002) GB
0230040.8 23 December 2002 (23.12.2002) GB
0310423.9 30 April 2003 (30.04.2003) GB

(71) Applicant (for all designated States except US): BAE
SYSTEMS PLC [GB/GB]; 6 Carlton Gardens, London
SW1Y 5AD (GB).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **GRIFFITH,**

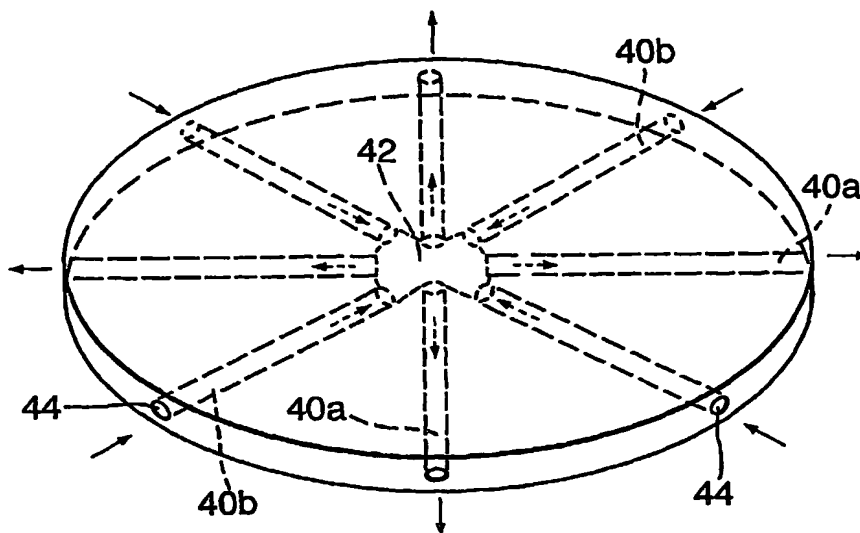
Michael, Stewart [GB/GB]; BAE Systems Advanced
Technology Centre, West Hanningfield Road, Great Baddow,
Chelmsford, Essex CM2 8HN (GB). **ARCHER,**
Nicholas, John [GB/GB]; BAE Systems Advanced Tech-
nology Centre, West Hanningfield Road, Great Baddow,
Chelmsford, Essex CM2 8HN (GB). **LAYCOCK, Leslie,**
Charles [GB/GB]; BAE Systems Advanced Technology
Centre, West Hanningfield Road, Great Baddow, Chelms-
ford, Essex CM2 8HN (GB).

(74) Agent: BAE SYSTEMS PLC; Group IP Department,
Lancaster House, P.O. Box 87, Farnborough Aerospace
Centre, Farnborough, Hampshire HU14 6YU (GB).

(81) Designated States (national): AE, AG, AL, AM, AT, AU,
AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR,
CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD,
GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR,
KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN,
MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU,
SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA,
UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

[Continued on next page]

(54) Title: DEFORMABLE-MIRROR COOLING



(57) Abstract: This invention relates to a cooled deformable-mirror and its mount. A deformable mirror is provided comprising a reflective element provided on a substrate that is secured to a deformable element, wherein the substrate comprises at least one channel having a pair of ports both located around the peripheral edge of the substrate. In addition, a deformable-mirror mount and the deformable mirror described above are provided, wherein the mount has a body with a central aperture defined by a supporting surface sized and shaped to support the mirror when installed, and wherein the mount is provided with at least a pair of channels that terminate to face the ports in the mirror when the mirror is installed, the channels of the mirror and the mount being connected via flexible seals.

WO 2004/057406 A3



(84) Designated States (*regional*): ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

(88) Date of publication of the international search report:
24 March 2005

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Published:

— with international search report

INTERNATIONAL SEARCH REPORT

Inter 1st Application No
PCT/GB 03/05507

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G02B26/06 G02B26/08 G02B7/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G02B H01S

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	IKRAMOV A V ET AL: "BIMORPH ADAPTIVE MIRROR" SOVIET JOURNAL OF QUANTUM ELECTRONICS, AMERICAN INSTITUTE OF PHYSICS. WOODBURY, NY, US, vol. 22, no. 2, 1 February 1992 (1992-02-01), pages 163-166, XP000273608	1-4, 17, 18
Y	figures 1,2	5, 9-12
X	DE 100 52 249 A (LT ULTRA PREC TECHNOLOGY GMBH) 25 April 2002 (2002-04-25) figures 1-3 paragraphs '0028! - '0034! ----- -/-	1-3, 17, 18

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- *&* document member of the same patent family

Date of the actual completion of the international search

29 October 2004

Date of mailing of the international search report

22 11. 2004

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel: (+31-70) 340-2040, Tx. 91 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Quertemont, E

INTERNATIONAL SEARCH REPORT

Inter national Application No
PCT/GB 03/05507

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 3 731 992 A (MANSELL D) 8 May 1973 (1973-05-08) figure 1 column 2, line 39 - line 42	5
X	US 4 674 848 A (DAIGNEAULT STEVEN M ET AL) 23 June 1987 (1987-06-23) figure 3 column 4, line 41 - line 45	6-8, 13-16
X	US 6 048 070 A (LAFIANDRA CARLO F) 11 April 2000 (2000-04-11) figure 1 column 2, line 55 - line 64	6-8
Y	US 6 307 688 B1 (BECKER JOCHEN ET AL) 23 October 2001 (2001-10-23) figures 1,2	9-12

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB 03/05507

Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-5,17,18

A deformable mirror, wherein the substrate comprises channels extending from a central portion of the substrate to the edge of the mirror in an offset arrangement.

2. claims: 6-16

A device comprising a deformable-mirror mount and a deformable mirror, the channels of the mirror and the mount being connected via flexible seals.

INTERNATIONAL SEARCH REPORT

Inter | Application No
PCT/GB 03/05507

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
DE 10052249	A	25-04-2002	DE	10052249 A1	25-04-2002
			AU	2060202 A	06-05-2002
			WO	0235274 A1	02-05-2002
US 3731992	A	08-05-1973	NONE		
US 4674848	A	23-06-1987	NONE		
US 6048070	A	11-04-2000	NONE		
US 6307688	B1	23-10-2001	DE	19859634 A1	29-06-2000
			EP	1014139 A2	28-06-2000
			JP	2000195788 A	14-07-2000
			TW	518428 B	21-01-2003